Frank Baldwin Jewett—John Fritz Medalist

By KARL T. COMPTON
FELLOW AIEE

The qualifications of the 1939 recipient of the highest American engineering honor are those of a leader, a statesman, and a nobleman of science

AMONG politicians there are few real statesmen, among the aristocracy few true noblemen, among the masses of men few leaders. Ever since I have known Frank Baldwin Jewett I have thought of him as one of that very small group who are the leaders, statesmen, and noblemen of science. I rejoice in this opportunity to say publicly this which I have long thought in private.

Not all leaders are statesmen. Willard Gibbs was a leader in the advancement of science, Beethoven was preeminent as a composer of music, and Mark Hanna was a great politician, but we do not think of them as statesmen. On quite another plane, Cortez in his conquest of Mexico and certain political bosses and racketeers were powerful leaders, but they were not statesmen. Statesmanship implies wise and farsighted leadership toward ultimate social welfare, based on fundamental principles rather than opportunism. Wisdom, energy, and altruism characterize statesmen.

Neither are all statesmen noblemen; for statesmen are not necessarily men of culture, of unselfish consideration of others in their personal relations, of unswerving loyalty to high principles in their personal lives. A father's ambition might be for his son to become a statesman, but a mother's love would hope that he become the kind of a person whom I call a nobleman.

With these distinctions in mind, it is not strange that few men can qualify outstandingly in all three directions. But Frank Jewett has been the leader in building up a great technical and research organization. He has been a statesman in his effective participation in the councils of science, engineering, and industry to make them of the greatest possible benefit to humanity. And he has been so unfailingly loyal and helpful to his host of friends and colleagues, never counting the cost to himself but considering only their best interests, that these friends will assuredly join with me in dubbing him a nobleman.

Frank Baldwin Jewett comes of a long line of New England ancestors, the earliest having settled in Rowley, Mass., in 1632, only 12 years after the landing of the Pilgrim Fathers. These ancestors played active roles in the civil, social, and religious life of New England throughout the colonial days and the early period of the republic. Among his great-uncles was a librarian of the Boston Public Library and a publisher who, among other things, published the first editions of "Uncle Tom's Cabin." My genealogical research has not been carried to the point of tracing the medalist's family connections with the 47 Jewetts appearing in the Boston telephone directory, but it is reasonable to assume that these are living evidence that the prominence of this Jewett family in New England still persists.

Frank Jewett, however, came from the more adventurous branch of the family, which went westward, and still westward to the newer lands of opportunity. His immediate forebears settled in Ohio, at Cincinnati, and then his parents, Stanley P. Jewett and Phebe C. (Mead) Jewett, moved to California. Frank Jewett was born in Pasadena on September 5, 1879.

Professional Education

His first professional education was in the field of electrical engineering at the Throop Polytechnic Institute, which later became the California Institute of Technology, and he graduated with the bachelor of arts degree in 1898. Even then he demonstrated his lifelong interest and faith in fundamental science, and his quality of not being satisfied with less than the best that was possible; for he went for advanced study in physics, mathematics, and chemistry to the vigorous young University of Chicago, to which Professor Michelson had brought especial prestige and opportunity in physics. Here he received the degree of doctor of philosophy in 1902. During his last year at Chicago, he was research assistant to Professor Michelson, who was then developing his echelon spectroscope and building his famous dividing engine for ruling large diffraction gratings. Here also he formed the lifelong friendship with Robert A. Millikan, then an instructor in physics at the university. In the past 25 years there has been scarcely any far-reaching national program in science for human welfare or for national defense but has found these two men as colleagues in the planning and executive councils.

Jewett's final stage of formal education was secured at the Massachusetts Institute of Technology where, from 1902 to 1904, he studied advanced electrical engineering

Full text of an address delivered at the John Fritz Medal presentation ceremonies during the AIEE winter convention, New York, N. Y., January 25, 1939.

KARL T. COMPTON is president of Massachusetts Institute of Technology, Cambridge. He was born at Wooster, Ohio, September 14, 1887, and received his formal education at the College of Wooster and Princeton University; many honorary degrees have since been conferred upon him. After serving as instructor at the College of Wooster and Reed College, he became assistant professor of physics at Princeton in 1915, and in 1929 was made chairman of the department. In the following year he was appointed president of MIT. Doctor Compton has been active in the National Research Council and the Science Advisory Board, among other organizations, and is a member of various technical societies. In 1931 he was awarded the Rumford Medal of the American Academy of Arts and Sciences.

and was an instructor in physics and electrical engineering. These were exciting fields in those days, as now. MIT was in close association with the developments in electric power engineering under Elihu Thomson, and the head of the physics department, Professor Cross, was a friend and frequent consultant of Alexander Graham Bell, whose company then had its headquarters in Boston. Of course it is Jewett's innate ability and thorough fundamental training which have brought him to the top of the communications development field, but it was this early association between MIT and the telephone company that gave him his initial direction into it.

In this field of electrical communications, the loading coil had recently been invented and showed promise of greatly extending the feasible range of telephonic communications. The mathematical and physical researches of Doctor G. A. Campbell had proved the enormous advantage of attacking this and similar research and development problems with the aid of the most powerful tools of mathematics and electrical science by men thoroughly trained to use them. Imbued with this conviction, Doctor Hammond V. Hayes, then chief engineer of the American Telephone and Telegraph Company, turned to MIT to find the best possible combination of ability and training, and selected the young Doctor Jewett for an association with the company which has been uninterrupted since 1904.

Doctor Jewett

Advancement in His Profession

To this work, Doctor Jewett brought not only scientific training and ability, but also enthusiasm and a marked gift for organization and administration. To these qualities were added also a remarkable intuitive faculty for sensing the directions of most advantageous experimentation and development. If to these qualities we add his keen judgment of men, ability to inspire loyalty, and the highest integrity, it is not difficult to understand Jewett's steady and rapid promotion to ever more important positions of responsibility.

Within three years after his employment by the company, he was put in charge of the electrical department, and shortly thereafter was made transmission and protection engineer; directing the work which led to phantom loading, and the loading of large-gauge open-wire circuits, and the development of phantom-duplex cables. In 1912 he was made assistant chief engineer of the Western Electric Company in New York, where most of the research and development work of the American Telephone and Telegraph Company was being concentrated. Four years later he became chief engineer, in charge of all scientific development and also the engineering work connected with the manufacturing activities of the Western Electric Company. In 1921 he was elected vice-president and a director, and in the following year he was put in charge of all the manufacturing, sales, and distribution activities of that company in America. In 1925 there was some reorganization of the American Telephone and Telegraph Company and Doctor Jewett became vice-president of that company, and a director of its long-lines department, and also president of the Bell Telephone Laboratories which were then formed as the central research organization to serve the entire system.

The marvelous development of the art of electrical communications within our lifetime is in its major part the product of Doctor Jewett's work, planning, and supervision, aided and implemented by his remarkably able and loyal army of colleagues in laboratory and office. After the loading coil came the vacuum-tube amplifier and its uses in telephony, wireless, and radio. These made possible the transcontinental telephone lines. Permalloy enormously improved the submarine cable lines. Carrier waves enormously increased the carrying capacity of existing lines. Transoceanic telephone communication by radio was established in 1927. The automatic dial system was developed and introduced without confusion. Radiotelephony, wire to wireless broadcasting, sound accompaniment to motion pictures, wire and wireless transmission of pictures, teletypewriters are all new products in wide use, while television and radically new types of transmission lines are among the current developments. Every one of these has, in turn, involved literally thousands of investigations systematically planned for years in advance of a product perfect enough to meet the requirements of public use.

It seems to me that three features uniquely characterize this story of development of an unequalled public service. Firstly, there has been unswerving adherence to the primary subject of electrical communication of information, whether by dot and dash, by word, or by picture. Secondly, there has been steady devotion to the ideal of giving the very best possible service to the public and sparing no efforts to improve this service. Thirdly is a peculiar

characteristic of the telephone business: Every new subscriber must be provided with possible connections to every other subscriber; hence the tremendous emphasis on automatic switching, multiple messages over wires, and the like, which alone prevented the costs of universal interconnection from soaring as the number of subscribers has increased. It is now possible for you or me to be connected for speech with about 97 per cent of all the telephones in the world!

Public Services

Turning now to Doctor Jewett's *pro-bono-publico* activities, which have been legion, but a few of the most important ones can be mentioned. He was active in forming the National Research Council, set up by the National Academy of Sciences as a measure of national defense at the request of President Wilson in 1916, and he served for several terms as chairman of its division of engineering and industrial research. As a lieutenant colonel in the Signal Corps during the great war, Doctor Jewett took a leading part in the development of communication devices for both Army and Navy. As one of the most active members of the Science Advisory Board, appointed by President Roosevelt during the severest depression years, he gave particular attention to military and naval problems, to development of a co-ordinated research program for the American railroads, and to the safety of ships at sea in fog. When, in this year 1938–39, the Army Air Corps seeks help on certain technical problems, and the National Resources Committee wants to know what industry is doing in the line of research, of course Doctor Jewett is again called upon for still more service.

That these are only a few among his many public services is indicated by some of his other memberships: policy committee of the National Research Council, past president of the AIEE, British Institution of Electrical Engineers, New York Electrical Society, Society for the Promotion of Engineering Education, American Philosophical Society, Institute of Radio Engineers, American Association for Advancement of Science, American Physical Society, Acoustical Society of America, and American Society of Arts and Sciences. He is a trustee of the Carnegie Institution of Washington, the Woods Hole Oceanographic Laboratory, and Tabor Academy. He is president and trustee of the New York Museum of Science and Industry, and a life member of the Corporation of the Massachusetts Institute of Technology.

Honors and Medals

Naturally this John Fritz Medal is not the first honorary recognition of so distinguished a career. At least nine universities have made him honorary doctor of science, engineering, and laws. He has received the AIEE Edison Medal in 1928, the Faraday Medal of the Institution of Electrical Engineers in 1935, the Franklin Medal of the Franklin Institute in 1936, and the Washington Award last year. From our government he received the Distinguished Service Medal, and from the Japanese government the Fourth Order of the Rising Sun in 1923 and the Third Order of the Sacred Treasure in 1930.

I have sketched Doctor Jewett's career, mentioned some of his public services, and listed some of his honors. I have not mentioned, on the more personal side, the multitude of friends and colleagues whom he has helped by advice and example. Many have had experiences similar to my own. I have gone to him in perplexity over some personal problem and come away with clarified vision and courage. It is for this reason that I am especially grateful to have had this opportunity to say these words about my friend and colleague, Frank Baldwin Jewett—leader, statesman, and nobleman of science.

Illumination Notes*

Conditioned Reflex and Traffic Lights. When through experience a new stimulus becomes effective to produce automatic response, the neural mechanism producing it is called a conditioned reflex. Pavlov produced conditioned reflexes in dogs by associating for them the ringing of a bell or tapping on the skin with immediately thereafter receiving food. After such conditioning of reflexes, the bell or the tapping would suffice in itself to produce a flow of saliva. In driving an automobile, the shift of the right foot from accelerator pedal to brake pedal, or vice versa, as traffic conditions call for deceleration or acceleration, becomes almost automatic and largely unconscious. The introduction of traffic lights created a new stimulus to that response and thus a conditioned reflex.

Now Pavlov found that by creating a second conditioned reflex, antagonistic to the first, the dog could be made highly nervous, and soon would lose all conditioned reflexes. Howard B. Fabing, in a report published in the *Journal* of the American Medical Association, in September 1938, points out that traffic lights result in just such a collision of conditioned reflexes. A driver approaching a traffic light showing green, and so proceeding under the "go ahead" stimulus, may find it suddenly change color and receive a quick conflicting stimulus; or, even if it does not change, he knows by experience that a change is possible. The report shows that this collision of conditioned reflexes does result in nervous strain, through an "anxiety neurosis in miniature," followed by a bodily reaction of exhaustion.

The realization, shared by most engineers, that present traffic signals are far from perfect, is strengthened by this showing that they are psychologically bad, and this should lead to increased striving after improvement. In the meantime we must perforce endure the lesser evil of collision of conditioned reflexes to escape the more serious disaster of frequent collision of cars.

* Contributed for the AIEE committee on production and application of light by L. A. Hawkins (A'03, M'13) executive engineer, research laboratory, General Electric Company, Schenectady, N. Y.